20/c

Rubber Research Scheme

(CEYLON.)

First Quarterly Circular

FOR

1926.

IMPERIAL BUREAU OF MYCOLOGY
25 MAR. 1927

Peradeniya, April, 1926.

GENTLEMEN,

Herewith the First Quarterly Circular for 1926, dealing with the following subjects :—

"Glass Hydrometers for Latex."

"Hydrometers for Formic Acid."

"Notes on Paranitrophenol."

By T. E. H. O'Brien, Chemist.

"A Relationship between Yield and Rainfall."

By R. A. Taylor, Physiological Botanist.

"The Spraying of Rubber Trees as a means of control of secondary leaf-fall."

By R. H. Stoughton-Harris, Mycologist.

Notice reference paranitrophenol.

Reports received.

J. MITCHELL,

Organising Secretary.

RUBBER RESEARCH SCHEME (CEYLON),
Peradeniya, 27th April, 1926.

GLASS HYDROMETERS FOR LATEX.

In previous issues of the R. R. S. Quarterly Circulars (2nd and 4th Circulars for 1924), an account was given of tests carried out with a glass hydrometer for testing the rubber content of latex. As a result of these experiments, a number of hydrometers made to the same pattern were obtained from England and further laboratory and factory tests have been carried out during the past year.

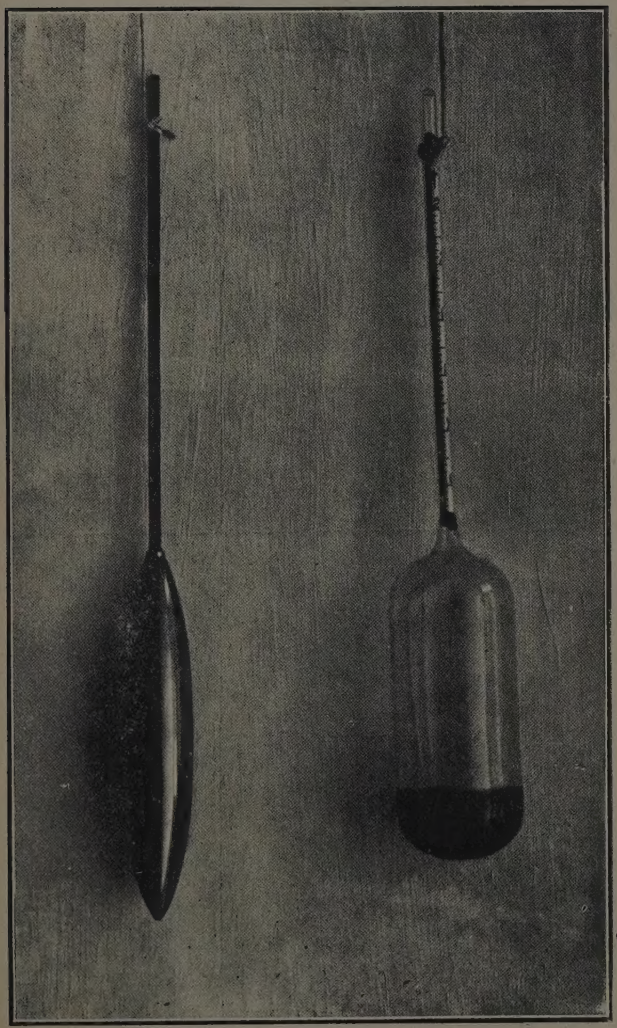
Before discussing these tests it is thought useful to mention the reasons for considering the adoption of a glass instrument in place of the brass "Metrolac" which is in common use in Ceylon. The chief advantage of a glass hydrometer is that its accuracy remains unchanged with constant use, whereas a brass one gradually wears and becomes unreliable. Recently 2 brass Metrolacs were received at the laboratories for correction, which were found to read 8 oz. and 9 oz. low in latex of 2 lbs. per gallon concentration. Another advantage of the glass hydrometer is that it is cheaper to make than the Metrolac, the respective prices being Rs. 10–12 and Rs. 30 each.

The obvious disadvantage of glass is that it is liable to break, but during the factory tests in Ceylon it has been shown that with careful handling there is little fear of breakage. If a glass hydrometer is dropped on the floor it breaks; a brass Metrolac under similar treatment becomes dented and is hardly more serviceable.

The uses of a latex hydrometer or Metrolac are as follows:—

1. "Weighing up" coolies latex.
2. Testing the rubber content of latex before coagulation.
3. Obtaining an advance estimate of the day's crop to supplement or replace the present method of weighing the wet rubber.

In a series of tests carried out daily at the laboratories on latex from different plots, a comparison was made between hydrometer and Metrolac readings, and the actual rubber content of the latex. The figures given below show the percentage error in calculating the weight of dry rubber from the hydrometer readings.



BRASS METROLAC. GLASS HYDROMETER.

BRASS METROLAC. (new)

Block	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Average for 7 mths.
A. (tapper's task)	+ 12.8%	+ 14.3	+ 14.0	+ 17.8	+ 18.6	+ 18.4	+ 17.1	+ 16.1
B. "	" 12.2	" 14.7	" 15.3	" 18.9	" 20.5	" 15.8	" 16.6	" 16.3
C. "	" 14.5	" 15.9	" 16.3	" 20.1	" 20.2	" 15.6	" 16.9	" 17.1
D. "	" 14.9	" 15.4	" 15.8	" 20.8	" 21.0	" 18.2	" 17.2	" 17.6
V. "	" 9.7	" 13,7	" 14.9	" 17.6	" 15.3	" 12.2	" 13.4	" 13.8
S. "	" 11,5	" 11.6	" 15.7	" 17.8	" 17.0	" 13.9	" 13.1	" 14.4

Average + 15.9%

GLASS HYDROMETER.

Bulked latex from Factory	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Average for 7 mths.
Block A.	+ 5.6%	+ 3.0	+ 3.8	+ 7.1	+ 8.9	+ 4.7	+ 0.7	+ 4.8
" B.	" 2.4	" 2.0	" 3.5	"10.8	" 7.7	" 8.2	" 7.7	" 6.0
" C.	" 1.5	" 1.7	" 4.8	"10.3	" 9.8	" 5.6	" 7.1	" 5.8
" D.	" 2.6	" 0.5	" 5.1	"12.5	" 9.6	" 5.1	" 6.9	" 6 0
" V.	" 4.3	" 1.9	" 2.7	"10.6	" 9 2	" 6.9	" 6.7	" 6.0
" S.	—3.5	—0.9	" 1.8	" 6.3	" 3.7	—0.4	" 1.3	" 1.2
	—3.5	—1.7	" 0.1	" 8.3	" 4.0	" 1.7	—0.8	" 1.2

Average + 4.4%

Note. A. B. C. & D. are adjacent blocks. V. & S. are adjacent plots. The points to be noted are:

1. The error with the glass hydrometer is less than with the Metrolac.
2. The accuracy of the hydrometer varies on different plots. This also applies to different estates.
3. The accuracy varies at different seasons, the highest readings being obtained in October to November.
4. Bulked latex gives the most uniform readings.

It was pointed out previously (2nd Quarterly Circular for 1924) that a hydrometer cannot be expected to give correct readings in all samples of latex, and the best that can be hoped is to devise a scale which will give good average results. To use a latex hydrometer to its best advantage it is obvious that a correction should be made where necessary, and the simplest plan appears to be to use the error of one month's results as the correction for the following month's readings. Correction of the figures given above on this principle gives the following results:—

BRASS METROLAC.

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Average for 6 months.
Block A.	+1.5%	—0.3	+3.8	+0.8	—0.2	—1.3	+0.7
„ B.	„ 2.5	+0.6	„ 3.6	„ 1.6	—4.7	+0.8	„ 0.7
„ C.	„ 1.4	„ 0.4	„ 3.8	„ 0.1	—4.6	„ 1.3	„ 0.4
„ D.	„ 0.5	„ 0.4	„ 5.0	„ 0.2	—2.8	—1.0	„ 0.4
„ V.	„ 4.0	„ 1.2	„ 2.7	—2.3	—3.1	+1.2	„ 0.6
„ S.	„ 0.1	„ 4.1	„ 2.1	—0.8	—3.1	—0.8	„ 0.3

Average + 0.5 %

GLASS HYDROMETER.

	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Average for 6 months.
Bulked latex	—2.6%	+0.8	+3.3	+1.7	—4.2	—4.0	—0.8
Block A.	—0.4	„ 1.5	„ 7.3	—3.1	+0.5	—0.5	+ 1.0
„ B.	+0.2	„ 3.1	„ 5.5	—0.5	—4.2	+1.5	„ 0.9
„ C.	—2.1	„ 4.6	„ 7.4	—2.9	—4.5	„ 1.8	„ 0.7
„ D.	—2.4	„ 0.8	„ 7.9	—1.4	—2.3	—0.2	„ 0.4
„ V.	+2.6	„ 2.7	„ 4.5	—2.6	—4.1	+1.7	„ 0.8
„ S.	„ 1.8	„ 1.8	„ 8.2	—4.3	—2.3	—2.48	„ 0.45

Average + 0.5%

It is evident from these figures that careful use of a hydrometer, whether glass or brass, can be expected to give accurate crop estimates when averaged over a period of months. If allowance had been made for the fact that high readings may be expected in October—November (in the Kalutara District), the figures would have been even more satisfactory. The readings were carried out by a Ceylonese Assistant and there appears to be no reason why equally good results should not be obtained in factory practice. It is known to the writer that on certain estates this method of estimating crop is used with success.

About 25 hydrometers were distributed to different estates and in a number of cases careful records were kept over a period of more than 6 months. The crop was estimated daily from hydrometer readings and volume of latex, and this figure was compared with the weight of the day's crop when dry. The total weight of rubber concerned in these tests amounts to more than half a million pounds. The results of the estate tests are variable. In some cases the hydrometer was found to give accurate results, in others there was a large error. The writer carried out tests on several of these estates, and in no case was the error found to be excessive, as is shown by the following figures:—

Estate No.	Error of hydrometer in tests carried out by the Chemist.	Error as shown by estate records.
1. (Matale)	—6.0%	—4.6%
5. (Kalutara)	+4.0%	—5.3%
9. (Kalutara)	+3.4%	+18.3%
11. (Kalutara)	+0.5%	—3.45%
13. (Kalutara)	—1.6%	
14. (Kalutara)	—3.5%	
15. (Kalutara)	+3.75%	
*16. (Kelani Valley)	+8.8%	

* 3 day tapping.

It is concluded that the discrepancies in certain of the estate figures, which were none the less valuable, were probably due to variations in the size of shanghai jars, and similar causes. The chief point of interest is that in most cases the variations from month to month were not large, showing that good results could be obtained by applying a correction as indicated above.

Out of 25 hydrometers distributed to estates 5 were broken in use which places the average "life" of a hydrometer at 2½ years. In several cases breakage occurred during the first few days, and after it was realised that a certain amount of care in handling was required, there was no further trouble.

The chief cause of breakage lies not in factory use but in transit through the Ceylon post. The hydrometers used in the foregoing tests were less robust than was intended, but the pattern which has now been adopted is considered to be capable of withstanding any treatment which may be meted out by the Post Office Officials. One of these hydrometers packed in saw dust in a wooden box (15" × 6" × 6") was thrown several times a distance of about 6 feet on to a cement floor without breaking.

Variable opinions are expressed by planters who have used the hydrometers, but on the whole they are highly favourable. In one or two cases the opinion is expressed that they are too fragile for estate use. Numerous enquiries have been received from planters who wish to purchase hydrometers.

A Report on the experiments was recently considered by the Technical Committee of the Research Scheme, and it was decided that the hydrometer could usefully be put on the market. A number of Colombo Firms have been approached with a view to stocking the instruments and it is hoped that a supply will be available before the end of this year.

The writer wishes to record his thanks to the Estate Superintendents who assisted in the experiments by undertaking factory tests.

(Signed) T. E. H. O'BRIEN,
Chemist.

RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
NEBODA.

13th April, 1926.

HYDROMETERS FOR FORMIC ACID.

Tests were carried out at the laboratories with a view to developing a suitable hydrometer for testing the strength of formic acid.

A dozen experimental hydrometers giving a direct reading in percentage formic acid have now been received from England. Unfortunately it has been found that different samples of commercial formic acid of the same strength may vary in specific gravity, so that the strength as indicated by the hydrometer may be inaccurate to the extent of 2—3%. It is also found that the specific gravity of formic acid changes rapidly with temperature, and a further inaccuracy occurs if the test is made at a temperature other than at which the hydrometer is calibrated (82.5°F.). In general it can be said that the hydrometer will indicate the strength of a sample of formic acid within 5%, and is likely to be useful in preventing mistakes in coagulation due to the use of diluted acid.

The present supply of hydrometers read approximately 4% too high, but they can be used satisfactorily if the necessary correction is made. They are available to Members of the Research Scheme at cost price, Rs. 6/-

(Signed) T. E. H. O'BRIEN,
Chemist.

RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
NEBODA.

13th April, 1926.

NOTES ON PARANITROPHENOL.

A number of tests with p.n.p. have now been carried out by Estate Superintendents, and in several cases sample sheets were forwarded to the laboratories to be tested for resistance to mould.

These samples were submitted to a severe test and in 3 cases it was found that the sheet treated with p. n. p. was completely resistant to mould. In 2 cases mould developed freely on the sample showing that the treatment with p. n. p. had not been carried out properly. It is not sufficient to place a pile of sheets in a jar of solution and leave them for ½ an hour. Care must be taken to ensure that every part of each sheet comes in contact with the solution, otherwise it cannot be expected that the sheets will be protected against mould.

The following method of treatment has been tested by the writer and can be relied on to give good results. A 1% solution of p. n. p. is made by dissolving 6½ ounces of p. n. p. in 40 gallons of water in a shanghai jar. A pile of 50—60 sheets is taken and these are placed one by one in the solution, each sheet being pushed well under the liquid before the next sheet is placed on top of it. When all the sheets have been immersed, the pile is removed from the jar and the procedure repeated, the sheets again being placed one by one in the solution. When this has been repeated 5 times the treatment is complete, and the next pile of sheets is dealt with in the same way. Forty gallons of solution should suffice for treatment of about 400 lbs. of rubber.

Paranitrophenol dissolves slowly in cold water but is readily soluble in boiling water. The solution for treatment of sheets can conveniently be prepared by dissolving 6½ ounces of p. n. p. in about ½ a bucket of boiling water. A black sediment remains undissolved and this should be removed by straining through muslin as the strong solution is poured into a jar containing 38 gallons of water. The solution should be well stirred and is then ready for use.

When p. n. p. is dissolved in tap water the solution has a bright yellow colour. This colour is chiefly due to the presence of lime in the water, which combines with the p.n.p. to form a salt. It was shown by W. Brown, (R.G.A Bulletin,

vol. 7, p. 522) that these salts are less efficient disinfectants than free p. n. p. and it is therefore desirable that the colour should be removed by addition of acid. When sheet is being soaked there is probably sufficient acid in each sheet to neutralise the portion of solution which is in contact with it; and no further acid is required. In the case of treatment of crepe with p. n. p. for prevention of spots, 3—4 oz. of acetic acid should be added to the solution.

A stock of para nitrophenol is now held by Messrs. The Colombo Commercial Co., Ltd., the price being Rs. 1-75 per lb. in lots of 14 lbs.

(Signed) T. E. H. O'BRIEN,
Chemist.

RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
NEBODA.

13th April, 1926.

A RELATIONSHIP BETWEEN YIELD AND RAINFALL.

For the last two years a small experiment has been running at Culloden to test the value of the six monthly changing-over of the tapping cut.

Four plots of approximately 180 trees each constitute the block under examination and on two of these plots the tapping is changed from one side of the tree to the other every March and September. In the other two plots the cut is never changed until the complete panel has become exhausted.

It is not proposed to deal here with the effects of this changing-over, the experiment has not been continued for a sufficiently long time, but an interesting fact has been brought to light by a comparison of the yields of these plots with the total rainfall.

In Fig. I. will be found the yield graphs for the two years for all the plots. After plotting these it was noticed that while all plots showed a remarkable drop in yield in July, 1924, all showed a large increase in July, 1925.

This suggested the plotting of the rainfall curve on a similar scale and this is also given above in Fig. I. It will be noticed that in nearly every case a rise in yield was accompanied by a decrease in the rainfall and *vice versa*.

The yield taken as average production of dry rubber per hundred trees per tapping for each month has been correlated with total rainfall during the month. The period covers twenty months so giving twenty pairs of observations for each of the four plots. Table I. gives the Correlation Table prepared for Plot B. It will be noticed that the general distribution of the figures in the squares shows a negative correlation between the two factors—Rainfall and Yield.

The Co-efficients of Correlation obtained for all plots are :—

A	— .544
B	— .493
C	— .603
D	— 457
Total Block	— .585

All these show definite correlation between the two.

From tables of probability it has been calculated that, for this number of samples, there is a twenty to one chance

of a figure −.444 being significant. All the co-efficients obtained exceed this, and the chances of the figure for plot C. (—.603) being significant are rather more than 100 to 1.

We may thus take it that Yield is in some way affected by rainfall.

Yield has also been correlated in the same way with the number of times, in each month, on which rain fell between 3-30 p.m. and 9-30 a.m. the following morning.

One of the tables constructed is given in Table 2, and the co-efficients obtained were: −

A	— .458
B	— .338
C	— .403
D	— .419
Total Block	— .450

These it will be seen are fairly consistent but only one of the figures for the plots exceeds the figure having a twenty to one chance of being significant.

The graph of number of days on which rain fell follows fairly closely the total rainfall curve, and some such figures would be expected.

Below will be found a figure in which total yield of the block is plotted in descending order against the months, rainfall for each month being also plotted.

Were the negative correlation complete the two curves would follow closely the diagonals of the figure.

As far as is known every tree was tapped on every tapping recorded and on very wet days no tapping at all was carried out, but it is possible that during the wetter months the tappers missed several of the poorer trees.

It is proposed, if data are available, to test the truth of the above correlation by repeating the investigation with a plot where the yield of every tree is recorded separately thus obviating several of these possible sources of error.

(Signed) R. A. TAYLOR.

RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
NEBODA.

16th April, 1926.

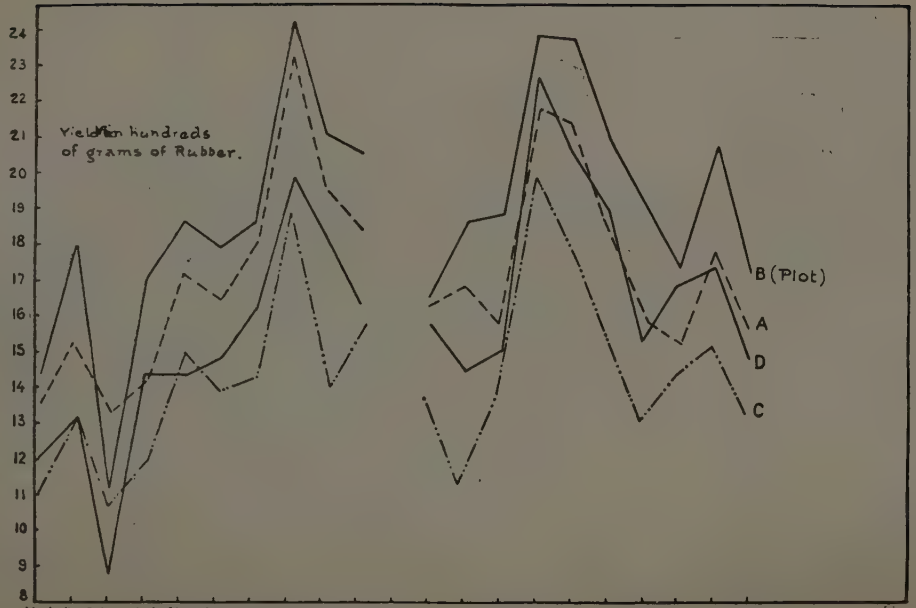


Fig 1. Yields of the four plots given as average per hundred trees per tapping for each month.

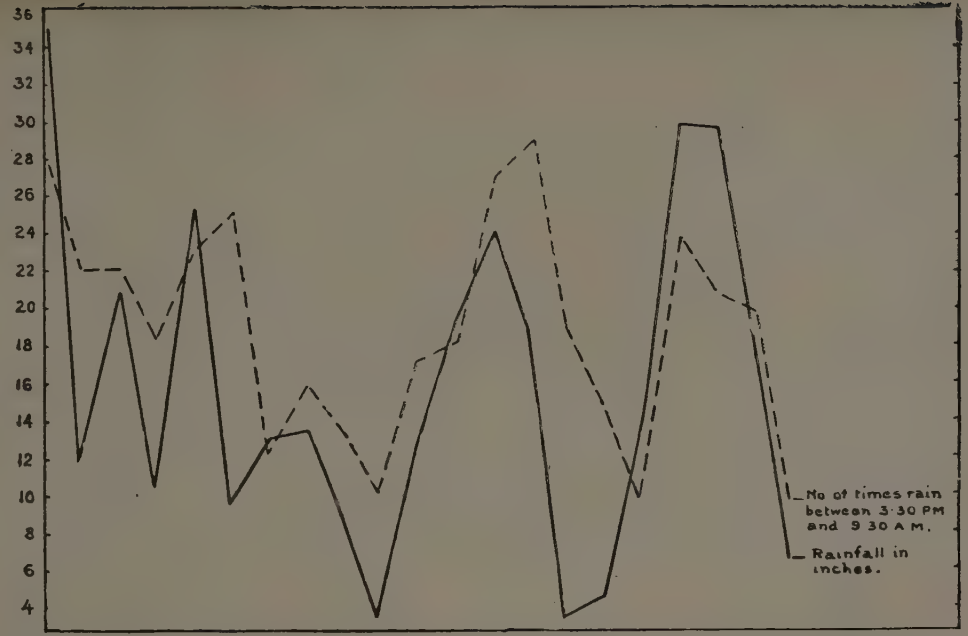


Fig.2. Rainfall for each month in inches and number of times each month on which rain fell between 3·30 P.M and 9·30 A.M the following morning.

Fig.3 Showing total yields for the block arranged in descending order and plotted against the months, with rainfall also plotted.

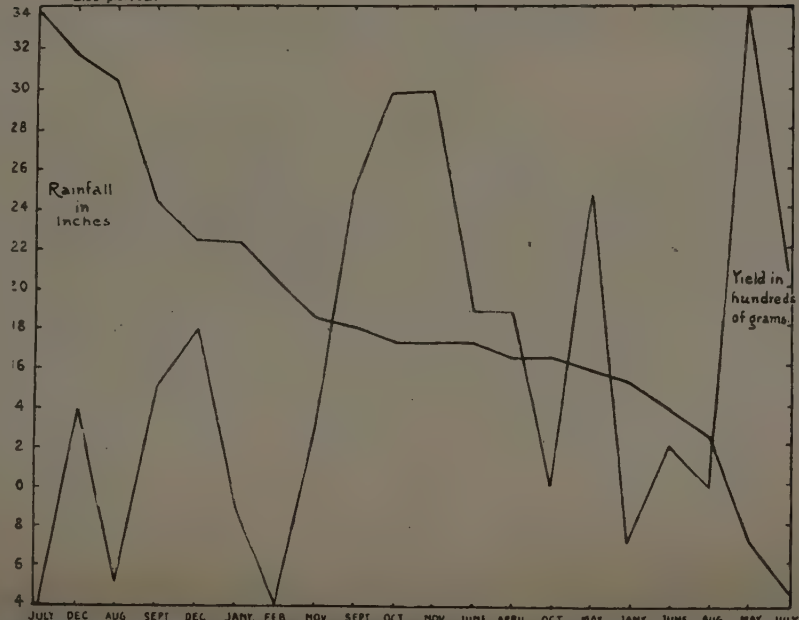


Table 1.—Correlation between Yield (given as average production of dry rubber per hundred trees per tapping, for each month) and rainfall in inches.

RAINFALL IN INCHES.

	.3	.5	.7	.9	.11	.13	.15	.17	.19	.21	.23	.25	.27	.29	.31	.33	.35	F
11	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...
14	...	...	...	..	...	...	...	...	...	...	...	...	...	..	...	...	1	1
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...
17	...	...	1	...	1	...	...	...	1	...	...	...	...	...	1	...	...	4
18	...	...	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	3
19	...	...	...	...	...	...	...	...	1	...	...	2	...	...	1	...	...	4
20	1	...	...	...	...	...	...		...	...	...	...	...	...	...	...	...	1
21	...	...	...	1	...	...	1	1	...	...	...	...	...	...	...	...	...	3
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	1	1	...	...	...	1	..	...	...	...	...	...	...	...	...	...	...	3
F	2	1	1	2	2	2	1	1	2	1	...	2	...	...	2	...	1	20

Rainfall
Mean, 16.1
Standard Deviation, 9.325

Yield
Mean, 1890 grams
Standard Deviation, 313 grams

Co-efficient of Correlation — .493

(17) **Table 2.**—Correlation between Yield (given as in Table I.) and number of times on which rain fell between 3.30 p.m. and 9·30 a.m. the following morning.

NUMBER OF TIMES ON WHICH RAIN FELL.

	.10	.11	.12	.13	.14	.15	.16	.17	.18	.19	.20	.21	.22	.23	.24	.25	.26	.27	.28	.29	F
11	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
15	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17	1	...	...	...	...	...	...	...	2	...	...	1	...	...	...	...	...	...	...	...	4
18	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	3
19	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	1	...	1	4
20	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
21	1	...	..	1	...	..	...	...	...	...	1	...	...	...	...	...	...	...	...	...	3
22	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
23	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
24	...	...	..	...	...	1	1	...	..	1	...	...	...	...	...	...	...	...	...	...	3
F	3	...	1	1	...	1	1	...	2	1	1	1	2	1	1	1	...	1	1	1	20

Number of times Rain

Mean. 19.15

Standard Deviation 5.91

Yield

Mean, 1890 grams

Standard Deviation, 313 grams

Co-efficient of Correlation — .338

THE SPRAYING OF RUBBER TREES AS A MEANS OF CONTROL OF SECONDARY LEAF-FALL.

The problem of the control of Secondary or Phytophthora Leaf-fall has for a long time exercised the minds of rubber scientists. In the Rubber Research Scheme Second Quarterly Circular for 1925 a note was published on the present position with regard to leaf diseases of rubber, and the general lines of attack and the inherent difficulties of each were indicated. Reference was made to the spraying operations carried out in S. India under the direction of Mr. H. Ashplant, Rubber Specialist to the United Planters' Association of S. India, and the success that had attended them. In view of the possible application of this method in Ceylon the Executive Committee of the Research Scheme decided that a visit should be paid to S. India to collect information on the methods adopted and the means of overcoming the difficulties. I accordingly travelled to Travancore on March 26th returning on April 4th. I should like at once to record my thanks to Mr. Ashplant for his hospitality during my stay and for the full and complete information and help that he gave me.

Before proceeding to a description of the actual methods employed, a word on the position with regard to leaf-fall in South India and the successful control by spraying would not be out of place. It should be realised that the intensity of attack in S. India is generally far greater than in Ceylon. In a bad year some 80% or more of the trees may lose nearly every leaf during the attack, and the effect on the whole area is that of a second "wintering." This much greater intensity may be put down to either or both of two main causes. In the first place the monsoon conditions are much more severe than is generally the case in Ceylon. Continuous heavy rains are experienced and for some three months the trees are hardly ever dry. In the second place, leaf fall in the two countries is caused by different species of Phytophthora. In South India *P. Meadii* has been identified as the causal organism, while in Ceylon *P. Faberi* is the agent. It is possible that a difference in potential virulence exists between the species.

With so grave an attack as is usual in South India some means of controlling the disease had to be discovered if the

health of the trees was to be maintained. In spraying Mr. Ashplant claims that the means have been found. Photographs of adjacent sprayed and unsprayed plots demonstrate conclusively that while the unsprayed plots may be to all intents and purposes completely defoliated a good cover is maintained on the sprayed trees throughout the year. It is not denied that some leaf is lost even in well sprayed rubber, but there is no question that a very high percentage is retained in full functioning power. Apart from this, or as an indirect result, there is definite evidence that the sprayed trees have a greater girth increment, hold their leaf longer at the normal wintering period and give a yield estimated conservatively at 10 lbs. per acre greater each year than unsprayed rubber. While this increase in yield does not appear large, too much stress should not be placed on this aspect. Many considerations would lead one to expect that a *direct* influence on yield would not result. The control of a leaf-disease should be looked on not from the point of view of possible immediate yield response but as a prevention of the future general debilitation caused by the disease.

At present there is little doubt that the need for controlling leaf-fall is generally not so urgent in Ceylon as in South India. Nevertheless, certain areas here suffer very severely from the disease and many Companies are willing to expend considerable sums to improve the position. In these areas spraying appears to be the solution, but it hardly seems advisable that estates should attempt to spray their whole acreage. Attention should at present be confined to those fields known to suffer badly from leaf-fall.

With these words of warning a full description of the methods employed in South India may be given.

Apparatus and equipment required.— There are at present in use in South India several makes of spraying machines but of these two have proved most successful, and one in particular. Attention will be confined to this one only as it is understood that some 50 or more of these outfits have already been sent to estates in Ceylon. The machine referred to is the D. S. P. "Headland" Pump manufactured by Messrs Drake & Fletcher, Maidstone, Kent, England.

This is a double-barrelled force pump with a large inlet hose with strainer, a steel pressure-chamber, and two ½ inch outlets with stop-cocks. The machine is sent out unmounted

but should be fixed to a small wooden platform with four projecting handles for carrying. Spares for the pump are supplied, but may usefully be augmented. A list of the more useful spares may be obtained from the Research Scheme. Two lengths of hose are required, each 75—120 feet long. If more than this length is used undue wear and many bursts and other troubles are probable. The only hose that has so far proved capable of standing up to the rough usage is the "Armada" Hose sold by Messrs. Drake & Fletcher. To the end of each length of hose is attached either a bamboo "lance", (a long bamboo with a screwed metal pipe within it) or a light 15 feet steel pipe. To the end of this is attached the nozzle. Many types of nozzle have been tried, but the most successful are the "Mistifier Junior" supplied by Messrs. Drake & Fletcher and the "Jumbo" nozzle sold by Messrs. Hayes & Co. of New York. A new type of combined lance and adjustable nozzle has been put on the market at the instigation of Mr. Ashplant called the Drake & Fletcher "Armada" Spray Gun, and this seems likely to prove very successful. With this instrument the type of spray produced is varied by turning the stop-cock at the handle end.

Besides the actual spraying apparatus there will be required for each machine,—

Four 40—50 gallon wooden barrels.

Two half barrels.

Two wooden buckets.

Two galvanized iron buckets.

Two fine-mesh latex strainers.

Two old coagulating dishes.

Six empty kerosene tins for water carrying.

One spring balance weighing to about 30 lbs. or

One household scales.

Labour.—The number of coolies required for each machine will vary according to the distance of the point of operation from a water supply. The labour is best apportioned as follows:—

2 coolies working the pump.

1 cooly stirring Bordeaux Mixture and relieving pumpers in rotation.

4 coolies spraying, 2 on each line.

2–6 coolies carrying water, and mixing the Bordeaux.

Preparation of Bordeaux Mixture.—Bordeaux Mixture is a brilliant bluish fluid prepared by the addition of a solution of Copper Sulphate to lime-water. A precipitate is formed which is kept in suspension in the water for a short time only unless continually stirred. This fine precipitate is the fungicidal substance.

The mixture commonly used for rubber is made up on the 4–4–50 formula; that is, 4 lbs. Copper Sulphate and 4 lbs. Quicklime to 50 gallons of water. These proportions should be adhered to whatever the amount of Bordeaux actually prepared. (Owing to the uncertain quality of most local Quicklime 5 lbs. may be necessary instead of 4 to neutralize all the Copper Sulphate.) To avoid delay in the preparation of the mixture two stock solutions should be prepared.

STOCK SOLUTIONS "A" COPPER SULPHATE.

The most convenient strength for this is 1 lb. Copper Sulphate to 1 gallon of water. Assuming that 50 gallon barrels are used 45 gallons of stock solution should be prepared the evening before spraying is to begin. Tie 45 lbs. of copper sulphate in a piece of old sacking and suspend this in 45 gallons of water in one of the barrels placed in the centre of the area to be sprayed on the following day. This quantity will be found sufficient for about two days' supply of Bordeaux.

STOCK SOLUTION "B" MILK OF LIME.

4—5 lbs. Quicklime are gradually slaked in an old coagulating dish for an hour or more, the whole tipped into a bucket, and mixed with about 2 gallons of water. The mixture is then strained into a barrel of water and made up to 46 gallons. This may be made up an hour or so before using.

MIXING THE BORDEAUX MIXTURE.

Bordeaux Mixture is most efficient when freshly prepared, and should therefore be made up as required from the two stock solutions A. & B. 4 gallons of the copper sulphate stock solution (A) are poured into the 46 gallons of milk of lime (B) giving 50 gallons of Bordeaux Mixture. For convenience in stirring this should be ladled out with a *wooden* bucket into a half-barrel from which the pump draws the supply for spraying.

It is essential that all the copper sulphate used should be neutralized by the lime. Theoretically 4 lbs. of Quicklime should be more than sufficient for 4 lbs. of copper sulphate, but owing to the impurity of much of the lime in use it may be necessary to add more milk of lime. Two simple tests are available for determining whether all the copper sulphate is precipitated. If any excess is present a bright knife blade dipped in the Bordeaux Mixture for a few minutes will be tarnished a copper red, indicating need for more lime. A more delicate test consists of adding a little weak Potassium Ferrocyanide solution to a few drops of Bordeaux Mixture in a saucer. A brownish colour indicates excess of copper. No more lime than is sufficient to neutralize the copper sulphate should be used.

The Spraying Operation.—For efficient spraying it is essential that the working pressure shown on the pressure-gauge should not fall below 150 lbs. per sq. in. 200 lbs. gives a good powerful spray.

For trees over six or seven years old climbing has to be resorted to. In South India climbing is usually done by means of a long bamboo cut so as to leave short pieces of the side branches to serve as foot-holds. One cooly climbs as high as possible with the spray-lance, while another remains half way up the tree to support the weight of the hose.

In spraying it should be remembered that the underside of the leaf and the petioles are the most vulnerable points for the attack of the fungus. The spray should therefore always be directed upwards. If a suitable nozzle is used to give a fine mist, the upper surfaces of the leaves will also be covered at the same time. It will usually be found necessary to climb every alternate tree in the row. The "Mistifier

NOTICE.

PARANITROPHENOL.

Subscribers are notified that paranitrophenol can now be obtained from the Colombo Commercial Co., Ltd., in 14 lbs. packets at a cost of Rs. 1-75 per lb.

REPORTS RECEIVED.

Report on "Trials to determine the liability of Smoked Sheet to develop Mould."

First Interim Report on "Artificial Ageing Tests on Plantation Rubber." (To be issued as Research Scheme Bulletin No. 41.)

Received from the London Advisory Committee.

Report on "The smoking of sheet rubber in relation to mould prevention." (To be issued as Research Scheme Bulletin No. 42.)

Received from Mr. T. E. H. O'Brien.

Report on "The Inter-relationship of Yield and the various vegetative characters in Hevea Brasiliensis." (To be issued as a Department of Agriculture Bulletin.)

Received from Mr. R. A. Taylor.

Miller & Co., Ltd.,